ago and mainland areas (Fig. 1b).

Our study provides evidence for the hypothesis that differences in twinning frequencies in historically relatively isolated[7] human populations may be maintained by natural selection, as the differences in the profitability of twinning between the areas are consistent with the predictions of life-history models. Such models suggest that predictable resource levels favour the evolution of increased reproductive output[8,9]. In the archipelago, the amount of food available has traditionally been relatively high and constant, with total crop failures being rare and with survival ensured by fishing. In poor mainland areas, on the other hand, crop failures and subsequent famines have been common throughout the centuries[10].

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A Roman "implant" reconsidered

A supposed "wrought iron" dental implant[1] was recently reported from a second century CE Gallo-Roman necropolis in Chantambre (Essonne, France), but in my view the data need to be re-evaluated in the light of what is known regarding ancient and modern dentistry[2–4]. The item is described as "severely corroded", for example, but an X-ray reveals a perfectly formed tooth with a smooth, intact surface free from the pitting expected on a small iron object interred for nearly 2,000 years under less than ideal conditions. The archaeological context and data on finds of iron in this and other tombs are not provided.

The production of a small, detailed replica of a human tooth in iron would test the skills of modern crafters. Less likely is that it would be accepted by a human body under questionably sterile conditions. This tooth appears to be a natural canine stained with oxides from proximity with an iron-rich object. This explains the detailed shape, its appearance in the X-ray, and the analytical results reported[1]. The principal types of known ancient dental appliances fall into two categories: decorative Etruscan examples of the seventh to first centuries BC[2,5,6] and functional Near Eastern wire examples, developed in about 400 BC to stabilize loose teeth until they could regain natural anchorage[7]. Both types are known from the ancient literature and from unequivocable archaeological examples. Dental implants are unknown in the ancient medical texts or literature, and no archaeological examples have been verified.

Modern dental techniques developed late in the nineteenth century and are still evolving. The development of sophisticated implant materials that are accepted by the body is a very recent achievement[8,9] related to parallel research done in bone joint replacement. Dental implantology is still emerging from experimental stages[10], and requires sophisticated high-technology alloys and bonds of complex composition. With space-age technology and the most modern antiseptic conditions, a five-year success rate of around 85% has now been achieved. Dental loss is commonly thought of as a normal factor of ageing, with replacements being limited to the well-to-do among the most industrialized countries. The likelihood that the ancient Romans would have been interested in attempting to fashion dental implants to replace lost teeth is remote.

I therefore suggest that the Chanatambre specimen is a natural tooth stained with iron oxides, and not an iron implant. We have good reason to marvel at the massive construction projects of the Romans, and at their delicate carvings on impressively hard gemstones. The ability of ancient "surgeons" throughout the world to cut pieces from human skulls and to have many of their patients survive is equally amazing. But whether they were interested in or capable of creating true dental implants in my view requires more evidence.

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Crubézy et al. *reply* — We disagree with Becker's view that the dental implant described in our earlier Scientific Correspondence[1] is a natural canine stained with iron oxides. The dental implant was located in a position normally taken by the upper second right premolar, a position in which a normal canine would not be found. Furthermore, the only goods associated with this burial were pottery, not iron or any metal objects[2]. Even if there had been iron oxide contamination, it is unlikely that it would have affected only one tooth. Figure 1a in our earlier Scientific Correspondence shows that the piece of metal is corroded on its periphery; the "smooth, intact surface" observed on the X-ray is a common artefact of the technique. Finally, we have already noted that the implant was broken and that metallurgical analysis unambiguously identifies it as metal and not as a biological tissue.

The fabrication of a "detailed replica" of a human tooth is not as dubious as Becker maintains. Chemical analysis indicates that the metal was given its shape through hot-hammering and folding, a basic technique of ancient blacksmiths, including those of Gallo–Roman times. Concerning the successful retention of the implant, it is possible that the iron could have facilitated the osseo-integration[3]; the absence of aseptic conditions does not systematically imply the rejection of the implant. The success of this procedure in an ancient population is no more amazing than the 70 per cent survival rate among patients who underwent trepanation[4] or the successful performance of cataract surgery[5].

Thus our anatomical, morphological, metallurgical and microscopic analyses of this specimen document, without question, the successful implantation of this dental prosthesis.

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